82D CONGRESS
*2d Session*
HOUSE OF REPRESENTATIVES
DOCUMENT
No. 374

# DULUTH-SUPERIOR HARBOR, MINN. AND WIS.

## LETTER

FROM

## THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, UNITED STATES ARMY, DATED SEPTEMBER 27, 1951, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND AN ILLUSTRATION ON A SURVEY OF DULUTH-SUPERIOR HARBOR, MINN. AND WIS., FOR DEEP-DRAFT NAVIGATION IMPROVEMENTS WHICH WOULD BE MOST ADVANTAGEOUS TO THE MOVEMENT OF IRON ORE. THIS INTERIM REPORT IS SUBMITTED UNDER THE AUTHORITY FOR A REVIEW OF REPORTS ON DULUTH-SUPERIOR HARBOR, MINN. AND WIS., REQUESTED BY A RESOLUTION OF THE COMMITTEE ON PUBLIC WORKS, HOUSE OF REPRESENTATIVES, ADOPTED ON JULY 13, 1949

MARCH 3, 1952.—Referred to the Committee on Public Works and ordered to be printed with one illustration

DEPARTMENT OF THE ARMY,
*Washington 25, D. C., February 19, 1952.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

DEAR MR. SPEAKER: I am transmitting herewith a report dated September 27, 1951, from the Chief of Engineers, United States Army, together with accompanying papers and an illustration, on a survey of Duluth-Superior Harbor, Minn. and Wis., for deep-draft navigation improvements which would be most advantageous to the movement of iron ore. This interim report is submitted under the authority for a review of reports on Duluth-Superior Harbor, Minn. and Wis., requested by a resolution of the Committee on Public Works, House of Representatives, adopted on July 13, 1949.

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In accordance with section 1 of Public Law 14, Seventy-ninth Congress, the views of the States of Minnesota and Wisconsin are set forth in the enclosed communications.

Although the Bureau of the Budget advises that there is no objection to the submission of the report to Congress, it states that any estimate of appropriation for the initiation of this project, if authorized by Congress, must be justified in accordance with the policy set forth in the President's letter to the Secretary of the Army dated July 21, 1950, concerning curtailment of civil public works. The complete views of the Bureau of the Budget are contained in the attached copy of its letter.

Sincerely yours,

FRANK PACE, Jr.,
*Secretary of the Army.*

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COMMENTS OF THE BUREAU OF THE BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
*Washington 25, D. C., February 12, 1952.*

The Honorable the SECRETARY OF THE ARMY
(Through the Budget Officer for the Department of the Army).

MY DEAR MR. SECRETARY: Receipt is acknowledged of your letter dated October 15, 1951, submitting the proposed interim report of the Chief of Engineers on Duluth-Superior Harbor, Minn. and Wis., requested by resolution of the Committee on Public Works, House of Representatives, adopted July 13, 1949.

I am authorized by the Director of the Bureau of the Budget to advise you that there would be no objection to the submission of the report to Congress.

The President in his letter to you, dated July 21, 1950, directed that all civil public works be considered with the objective, as far as practical, of deferring, curtailing, or slowing down those projects which do not directly contribute to defense or to civilian requirements essential in the changed international situation. Therefore, any estimate of appropriation for the initiation of this project, if authorized by the Congress, must be justified in accordance with the policy set forth in the President's letter referred to above or any modifications thereof.

Sincerely yours,

WM. F. MCCANDLESS,
*Assistant Director, Estimates.*

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COMMENTS OF THE STATE OF MINNESOTA

STATE OF MINNESOTA,
DEPARTMENT OF CONSERVATION,
*St. Paul 1, Minn., September 18, 1951.*

Gen. LEWIS A. PICK,
*Major General, Chief of Engineers,*
*Department of the Army, Washington 25, D. C.*

DEAR GENERAL PICK: This has reference to your letter of June 1[illegible] and the accompanying copy of the Interim Review Report on Survey of Duluth-Superior Harbor, Minn. and Wis., including reports of th[illegible]

Board of Engineers for Rivers and Harbors and the district and division engineers forwarded to me in accordance with the provisions of section 1 of Public Law 14, Seventy-ninth Congress.

There is no State agency in Minnesota that has been given specific jurisdiction by law over navigation especially on the Great Lakes. In the absence of such an agency reports of the United States Engineers required by law to be filed with the State are referred to the department of conservation for attention and comments. In weighing the merits of such reports the department attempts to learn of the reactions of public and private interests to proposals and recommendations made therein.

No objections have been heard to the proposals contained in the report. The department has not, on its own initiative, made sufficient investigation of the matters and proposals contained in the report to be in a position to make any critical observations.

I think it can be stated without qualification that the deepening of the Superior Front Channel from 22 feet to 25 feet is a project which merits early completion. With greater and greater demands being made on the iron ore of the Minnesota ranges for defense and peacetime needs, the loading to capacity of carriers becomes more and more in the interest of economy and any additional depths of the navigation channels to allow this to be done is all to the good. It is not conceivable how any interests engaged in navigation or dependent on the efficient handling of lake freight can find any objection to such a proposal.

Very truly yours,

CHESTER S. WILSON,
*Commissioner of Conservation.*

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## COMMENTS OF THE STATE OF WISCONSIN

THE STATE OF WISCONSIN, BUREAU OF ENGINEERING,
STATE PLANNING DIVISION,
*Madison 2, July 16, 1951.*

LEWIS A. PICK,
*Major General, Chief of Engineers,*
*Department of the Army, Washington 25, D. C.*

DEAR GENERAL PICK: Your letter of June 19 and the accompanying copy of your proposed report, together with the reports of the Board of Engineers for Rivers and Harbors and of the district and division engineers on an Interim Report on Survey of the Duluth-Superior Harbor, Minn. and Wis., forwarded to me in accordance with the provisions of section 1 of Public Law 14, Seventy-ninth Congress, were received in due course, I delayed answering it in view of the fact that I expected to be in Superior in early July, which would give me an opportunity to inquire into the situation more particularly.

Accordingly, I was in Superior on Wednesday, July 11. Previous to this visit I had read and studied the report quite carefully. As a result of information gained through the report and conferences with various interested people, it seemed to me that the proposed improvements were very necessary and desirable, and it appears that the recommendations of the report are in complete accordance with the wishes of local interests at Superior. The only suggestion I could

make in connection with the report is that its recommendations be expedited as much as possible in view of the great necessity for loading all ore carriers to their full capacity, which is not possible at the present time, when it so happens that the Duluth entrance is blocked, as occasionally happens.

Respectfully submitted.

M. W. TORKELSON,
*Director of Regional Planning,*
*State Planning Division, Bureau of Engineering.*

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REPORT OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington 25, D. C., September 27, 1951.*

Subject: Duluth-Superior Harbor, Minn. and Wis.
To: The Secretary of the Army.

1. I submit herewith for transmission to Congress the report of the Board of Engineers for Rivers and Harbors in response to resolution of the Committee on Public Works of the House of Representatives, adopted July 13, 1949, requesting the Board to review the reports on Duluth-Superior Harbor, Minn. and Wis., submitted in House Document No. 482, Seventy-second Congress, second session, with a view to determining whether further improvements for navigation are advisable at this time. This report considers only the deep-draft navigation improvements at Duluth-Superior Harbor which would be most advantageous to the movement of iron ore, with particular reference to the deepening of Superior front channel and the southerly part of East Gate Basin, and the widening of the channel in East Gate Basin at Rices Point. A final report under the authorization will be submitted at a later date.

2. After full consideration of the reports secured from the district and division engineers, the Board recommends modification of the existing project for Duluth-Superior Harbor, Minn. and Wis., to provide for deepening Superior Front Channel, and deepening the portion of East Gate Basin channel which has an existing project depth of 22 feet, both to 25 feet, generally in accordance with the plans of the district engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated cost to the United States of $562,500 for new work and no increase in the annual cost of maintenance, subject to the condition that local interests give assurances satisfactory to the Secretary of the Army that they will: (*a*) provide without cost to the United States all necessary lands, easements, and rights-of-way for the initial construction, and for subsequent maintenance when and as required; and (*b*) hold and save the United States free from damages due to the construction and maintenance of the project.

3. After due consideration of these reports, I concur in the views and recommendations of the Board.

LEWIS A. PICK,
*Lieutenant General, Chief of Engineers.*

## REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

DEPARTMENT OF THE ARMY,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington 25, D. C., June 6, 1951.*

Subject: Duluth-Superior Harbor, Minn. and Wis.
To: The Chief of Engineers, United States Army.

1. This interim report is submitted in response to the following resolution adopted July 13, 1949:

*Resolved by the Committee on Public Works of the House of Representatives, United States,* That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on Duluth-Superior Harbor, Minn. and Wis., submitted in House Document No. 482, Seventy-second Congress, second session, with a view to determining whether further improvements for navigation are advisable at this time.

This report considers only the deep-draft navigation improvements at Duluth-Superior Harbor which would be most advantageous to the movement of iron ore, with particular reference to the deepening of Superior front channel and the southerly part of East Gate Basin, and the widening of the channel in East Gate Basin at Rices Point. A final report under the authorization will be submitted at a later date.

2. Duluth-Superior Harbor, at the western extremity of Lake Superior, includes Superior Bay, a landlocked body of water separated from the lake by a long narrow sand spit known as Minnesota Point; a number of other bays; and the lower part of St. Louis River. It has several large basins and 17 miles of dredged channels. Two entries 6 miles apart have been provided through Minnesota Point to Superior Bay, the northerly known as Duluth entry and the southerly known as Superior entry. The improved 22-foot Superior front channel extends northwesterly in Superior Bay from the 25-foot Superior Harbor Basin just inside the Superior entry to the 22-foot section of East Gate Basin just southeast of Rices Point. That part of East Gate Basin adjacent to Rices Point has a project depth of 25 feet. It provides access to improved channels in St. Louis Bay on the west. The existing project authorized by Congress provides, in addition to related channels, for: (*a*) rebuilding the canal piers at Duluth entry with stone-filled timber-crib substructure and concrete superstructure 1,734 feet long and 300 feet apart for 1,250 feet, then flaring to 540 feet apart at the harbor end; (*b*) replacing the north and south piers at Superior entry with concrete piers 2,096 and 1,584 feet long, respectively, 500 feet apart for 808 feet, then flaring at the harbor end; (*c*) constructing 4,205 feet of rubble-mound breakwater, 900 feet of concrete pierheads on stone-filled cribs, and 896 feet of concrete shore revetments at Superior entry, the lake ends being 600 feet apart on the 30-foot contour in prolongation of the entrance channel and diverging to 2,100 feet apart at the shore line; (*d*) a flared lake approach to Duluth entry 32 feet deep, and a channel between the piers 32 feet deep at the pierheads; gradually decreasing to 26 feet at the harbor basin; (*e*) a depth of 26 feet in the northern part of the harbor basin inside Duluth entry consisting of 201 acres; a depth of 25 feet in the southern portion of the harbor basin and part of the East Gate Basin; a depth of 22 feet in the remainder of East Gate Basin; and a depth of 22 feet in Superior front channel, through Superior Bay, 600 feet in

width, extending to Superior Harbor Basin, a distance of 13,200 feet; (*f*) a flared lake approach to Superior entry 32 feet deep; a channel between the breakwater entrance and the pierheads with a width varying from a minimum of 600 feet to a maximum of 1,100 feet, 32 feet deep at the breakwater entrance, gradually decreasing to 28 feet at the pierheads; a stilling basin of 20 acres, 24 feet deep, inside the breakwater; and a channel between the piers, 28 feet deep at the pierheads, gradually decreasing to 25 feet at the harbor basin; and (*g*) a harbor basin of 290 acres, 25 feet deep, inside Superior entry. The project was completed in 1935. Cost of the existing project to December 31, 1950, was $9,990,000 of which $6,857,000 was for new work and $3,133,000 was for maintenance. The approved estimate of annual cost of maintenance is $140,000.

3. The cities of Duluth, Cloquet, and Proctor, Minn., and Superior and Oliver, Wis., comprise the metropolitan district which had a population of 252,000 in 1950. It is a diversified industrial area in which there are about 160 manufacturing establishments employing over 5,000 people. Water-borne commerce of Duluth-Superior Harbor for the years 1940 through 1949 fluctuated between a low of 54,147,695 tons in 1940 and a high of 74,314,646 tons in 1942, and averaged 64,214,093 tons annually. Included in this average tonnage were shipments of 50,042,230 tons of iron ore. In addition to iron ore, the commerce consisted principally of shipments and receipts of grain and iron and steel; and receipts of coal and coke, limestone, and petroleum products. Vessels using the harbor regularly, exclusive of federally operated craft, are typical iron ore, coal, and stone bulk carriers; oil tankers; and self-unloaders. They have lengths from 350 to 678 feet and drafts up to 24 feet. During the period 1940 through 1949, these vessels annually averaged 5,276 trips to and 5,283 trips from the harbor. An oil pipe line has recently been constructed from Edmonton, Canada, to Superior, and oil tankers with drafts up to 26 feet are being constructed for the newly developing crude-oil trade.

4. Local interests, including the Lake Carriers' Association, request that Superior Front Channel and all of East Gate Basin be dredged to a depth of 25 feet and that the channel in East Gate Basin be widened in the vicinity of Rices Point at a depth of 25 feet. Other improvements which they request are outside the scope of this report but they will be considered in later reports. Local interests state that ice conditions practically every spring and often in the fall prevent the use of one of the harbor entries. They also state that the use of one entry could be prevented in the busy summer season by being blocked by a vessel due to an accident. They claim that deepening the Superior Front Channel would enable vessels to carry capacity cargoes of iron ore and utilize either of the two entries. They claim that widening of the channel at Rices Point in East Gate Basin would provide increased safety and convenience by easing the right-angle turn for vessels using the iron ore and coal terminals located in the inner Duluth-Superior Harbor. They signify a willingness to provide the necessary land for spoil disposal.

5. The district engineer proposes a plan for improvement of the Superior Front Channel including a portion of the East Gate Basin. It provides for an increase in project depth from 22 feet to 25 feet in order to accommodate the existing and prospective traffic that requires

a depth of 25 feet in the event that either the Superior entry or Duluth entry is blocked. He believes the existing project widths are adequate for this portion of the harbor. He states that additional width toward the east in East Gate Basin can be provided by local interests as has been done progressively in the past under permit. The plan for widening East Gate Basin at Rices Point provides for moving the 25-foot project line shoreward a maximum of 170 feet for about 2,000 feet along the channel, all as shown on the map accompanying his report. He estimates the cost of deepening the Superior Front Channel and the 22-foot portion of East Gate Basin at $562,500 and of widening the East Gate Basin at Rices Point at $69,600, a total of $632,100 for the two parts with no increase in the annual cost of maintenance. He estimates the annual carrying charges at $21,900 and $2,700, respectively, for the two parts. The district engineer states that during the navigation season there is an average annual ice blockade at either the Superior entry or the Duluth entry for a period of 12 days. Due to this condition ore vessels which are compelled to use the 22-foot Superior Front Channel are unable to load to capacity. He estimates the loss in tonnage due to underloading at 42,300 tons of iron ore for the 12 days of blockade, or four extra cargoes. The cost of a round trip for one vessel between Duluth-Superior Harbor and a typical harbor on the lower lakes is $10,875. Therefore, the benefit creditable to deepening the Superior Front Channel and the southerly portion of East Gate Basin to 25 feet is estimated at $43,500 for the four extra cargoes. The benefit-cost ratio is 2.0 and the district engineer concludes that the improvement is economically justified. For the improvement at Rices Point, the district engineer states that there are between 6,000 and 8,000 deep-draft vessels passing the point annually. Under existing conditions, navigation by the large vessels is hazardous because of a lack of sufficient maneuvering room on the inside of the turn. The proposed widening of the channel at Rices Point would effectively improve navigating conditions with resulting benefit considered at least equal to the ensuing annual charges. He considers it to be in the public interest for the United States to deepen the Superior Front Channel and a portion of the East Gate Basin, and to widen the East Gate Basin at Rices Point. Therefore, he recommends the improvements subject to the provisions that local interests provide necessary land, easements, and rights-of-way for the construction and maintenance of the project when and as required, and hold and save the United States free from damages that may result from the construction and maintenance of the project. The division engineer concurs.

6. Local interests were informed of the recommendations of the reporting officers and given an opportunity to present additional information to the Board. No communications have been received.

## VIEWS AND RECOMMENDATIONS OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

7. The Board of Engineers for Rivers and Harbors concurs generally in the recommendations of the reporting officers. It notes that the 22-foot Superior front channel is the connecting link between the Duluth and the Superior portions of the harbor. A depth of 25 feet in this channel to correspond with that depth in the chan-

nels and basins in the two portions of the harbor and in the connecting channels of the Great Lakes will permit ore boats loaded to capacity to pass from one part of the harbor to the other. In this manner, capacity-loaded ore boats can use either of the harbor entries. The Board concurs in the view that the improvement is economically justified. The Board believes that the widening of East Gate Basin at Rices Point is justified in the interest of safety and convenience to established navigation. However, the Board is of the opinion that such widening may be accomplished under the existing project without further authorization.

8. Accordingly, the Board recommends modification of the existing project for Duluth-Superior Harbor, Minn. and Wis., to provide for deepening Superior front channel, and deepening the portion of East Gate Basin channel which has an existing project depth of 22 feet, both to 25 feet, generally in accordance with the plans of the district engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated cost to the United States of $562,500 for new work and no increase in the annual cost of maintenance, subject to the condition that local interests give assurances satisfactory to the Secretary of the Army that they will: (*a*) Provide without cost to the United States all necessary lands, easements, and rights-of-way for the initial construction, and for subsequent maintenance when and as required; and (*b*) hold and save the United States free from damages due to the construction and maintenance of the project.

For the Board:

D. G. Shingler,
*Brigadier General,*
*Chairman.*

## REPORT OF THE DISTRICT ENGINEER

### SYLLABUS

The district engineer finds there is need and justification for increased depth in Superior front channel and for increased width at Rices Point in East Gate Basin. He recommends modification of the existing project to provide for a depth of 25 feet in Superior front channel and a portion of East Gate Basin and increased width at Rices Point to a depth of 25 feet at an estimated first cost to the United States of $632,100 with no increase in the annual cost of maintenance, subject to prior compliance with certain conditions of local cooperation.

Corps of Engineers, United States Army,
Office of the District Engineer, Duluth District,
*Duluth 1, Minn., March 28, 1951.*

Subject: Interim Review Report on Surveys of Duluth-Superior Harbor, Minn. and Wis.

To: The Division Engineer, Great Lakes Division, Corps of Engineers, United States Army, Chicago 15, Ill.

### AUTHORITY

1. This interim review report of survey scope is submitted in compliance with the following resolution adopted July 13, 1949:

*Resolved by the Committee on Public Works of the House of Representatives, United States,* That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on Duluth-Superior Harbor, Minnesota

and Wisconsin, submitted in House Document No. 482, Seventy-second Congress, Second Session, with a view to determining whether further improvements for navigation are advisable at this time.

The Chief of Engineers on September 19, 1950, authorized the submission of an interim review report of survey scope to consider the deep-draft navigation improvements requested at Duluth-Superior Harbor which would be most advantageous to the movement of iron ore, with particular reference to the deepening of Superior Front Channel.

2. The submission of the review report on Duluth-Superior Harbor in connection with the above resolution is divided as follows:

(*a*) This interim survey scope report considering requested modification to the Superior Front Channel and at Rices Point in East Gate Basin.

(*b*) A final review survey scope report to be submitted later covering other considered improvements at this harbor including modification of the existing project in Minnesota Channel and Howards Bay, removal of Lamborn Avenue Bridge in Howards Bay, realinement of the fender piers at the Duluth and Superior Bridge and provision of a channel for light-draft vessels in the St. Louis River up to Fond du Lac, Minn.

SCOPE OF SURVEY

3. This interim report and the accompanying maps were prepared from maps, probing and other data on file in this office, supplemented by limited instrumental field surveys, including soundings, topography, dredged test pits, and additional probings to show present conditions. The Lake Carriers' Association, vessel interests using the harbor and interested local marine shippers, business concerns, and governmental agencies were advised of the nature of this interim report, its conclusions and the proposed recommendations by this office as indicated in paragraphs 58 to 61, inclusive.

NATURE OF REPORTS BEING REVIEWED

4. House Document No. 482, Seventy-second Congress, second session, contains report submitted in accordance with the River and Harbor Act approved July 3, 1930, which provided that a preliminary examination and survey report be made at Duluth-Superior Harbor, Minn. and Wis. The survey report, transmitted to Congress on December 5, 1932, recommended modification of the then existing project for Duluth-Superior Harbor to provide the following channels and basins:

(*a*) A flared lake approach to Duluth entry 32 feet deep; and a channel between the piers 32 feet deep at the pierheads, gradually decreasing to 26 feet at the harbor basin.

(*b*) A flared lake approach to Superior entry 32 feet deep; a channel between the breakwater entrance and the pierheads, with a width varying from a minimum of 600 feet to a maximum of 1,100 feet, 32 feet deep at the breakwater entrance, gradually decreasing to 28 feet at the pierheads; the maintenance of a stilling basin of 20 acres, 24 feet deep, inside the breakwater; and a channel between the piers, 28 feet at the pierheads, gradually decreasing to 25 feet at the harbor basin.

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(*c*) A depth of 26 feet in the northern part of the harbor basin inside Duluth entry consisting of 201 acres; a depth of 25 feet in the southern portion of the harbor basin and part of East Gate Basin; and a depth of 22 feet in the remainder of East Gate Basin; these areas to be extended to the line marked "Limit of project for maintenance," as shown on the map accompanying this report, as fast as the bulk of the material outside the existing project limits is dredged by local interests.

(*d*) A harbor basin of 290 acres 25 feet deep inside Superior entry; and Superior front channel through Superior Bay, 13,200 feet long, 600 feet wide, and 22 feet deep.

(*e*) A depth of 25 feet in the south channel of St. Louis Bay from the entrance to the cross channel, inclusive, with widths varying from 500 to 900 feet; a cross-channel of the same depth with minimum width of 1,150 feet, and a depth of 25 feet in the north channel of St. Louis Bay opposite the cross-channel; elsewhere in the north channel and the south channels and the St. Louis River to a point 9,600 feet above Grassy Point Bridge, a depth of 21 feet and a minimum width of 400 feet, except at Arrowhead Bridge; and the maintenance of the channel thence up St. Louis River a distance of about 14,200 feet to Spirit Lake, with 200 feet width and 20 feet depth.

(*f*) A channel in Allouez Bay 2,100 feet long, 400 feet wide and 22 feet deep; a channel in Howards Bay 6,000 feet long, narrowing in width from 300 feet to 125 feet, and 21 feet deep; and the maintenance of the Twenty-first Avenue west channel 3,300 feet long, 100 feet wide and 20 feet deep.

5. The total estimated cost to provide the above-described channels and basins was $1,319,000 with maintenance of the project as so modified at an estimated cost of $100,000 annually. The recommended modifications of the project were authorized by River and Harbor Act approved August 30, 1935.

DESCRIPTION

6. Duluth-Superior Harbor is located behind Minnesota Point, a natural breakwater 9 miles long, at the extreme westerly end of Lake Superior 394 miles from Sault Ste. Marie, Mich. The harbor comprises the navigable waters of the city of Duluth, Minn., on the north side and the city of Superior, Wis., on the south side to the city limits of each, as existing in 1894, including the Duluth entry, Superior entry, Superior Bay, Allouez Bay, St. Louis Bay, Howards Bay and the St. Louis River to the head of navigation at Fond du Lac, Minn. Before improvement, the bays were broad expanses of shallow water threaded by deeper but variable channels. The natural entrance from Lake Superior was into Superior Bay through a winding channel over a shifting sand bar near the present location of Superior entry. Improvements by the United States have included the formation of the two existing entrances, the widening and deepening of channels, and the provision of extensive turning and anchorage basins. There are 17 miles of dredged channels and about 49 miles of water frontage. The principal channels and basins in Superior and St. Louis Bays are well marked by can and lighted buoys and lighted ranges. A description of the various channels and basins is given in paragraph 23, existing project. The sides of the channels or basins adjacent to

harbor lines generally are 150 feet distant from the harbor lines and parallel thereto. The general location of Duluth-Superior Harbor and its relation to other ports is shown on United States Lake Survey Charts Nos. 0, 9, 96, and 966, and on the map accompanying this report.

7. Except as otherwise stated, depths mentioned in this report are referred to low-water datum for Lake Superior which is 601.6 feet above mean tide at New York. Since 1900, the greatest annual fluctuation in water level shown by the highest and lowest monthly means of any year was about 2 feet and the least annual fluctuation was about one-half foot. During the navigation seasons for the past 20 years the water level has fluctuated between datum and 2 feet above datum. Lake Superior is nontidal but winds and variations in barometric pressures produce changes in lake level ranging from a few inches to 2 or 3 feet above or below the level prevailing at the time. The severe storm of November 28, 1905, temporarily raised the water level in Duluth Harbor to 2.3 feet above the normal or unaffected stage of the lake.

8. Through joint action on the part of the United States and Canada, the elevation of Lake Superior is regulated by compensating works, located in the St. Marys River at the head of St. Marys Falls at Sault Ste. Marie, which consist of dikes and sluice gates so operated as to vary the volume of discharge from the lake. This regulation normally limits the fluctuation of the lake surface within a range between the elevations of low-water datum and 2 feet above low-water datum.

9. There have been no prescribed conditions of local cooperation in connection with the Federal improvement of Duluth-Superior Harbor. Therefore, the subject of local cooperation on existing and prior projects is not involved in this interim report. Likewise, the problems of water power and other special subjects involving the control or conservation of water resources are not applicable.

## TRIBUTARY AREA

10. The Duluth-Superior metropolitan district is comprised of the following incorporated cities: Duluth, Minn.; Superior, Wis.; Cloquet, Minn.; Oliver, Wis.; and Proctor, Minn. In 1950 the population of this district was about 252,000. The city of Duluth, the largest city in the metropolitan district, had a 1950 population of about 104,000. It is the county seat of St. Louis County which had a population in 1950 of about 205,000. Superior, the second largest city in the metropolitan district, is the county seat of Douglas County which had a population in 1940 of about 47,000. The Duluth-Superior district is a diversified industrial area with 18 banks having resources in 1950 totaling about $160,000,000. There are about 160 manufacturing establishments employing over 5,000 people.

11. Tonnage by boat movement in and out of Duluth-Superior Harbor amounts to some 60,000,000 to 70,000,000 tons per year which is second to New York of harbors in the United States. It consists prinicpally of shipment of iron ore mined in the Mesabi, Vermilion, and Cuyuna iron ranges about 50 to 90 miles north, northeast, and west, respectively, of Duluth; shipment and receipt of grain; shipment and receipt of iron and scrap iron; and receipt of coal and lime-

stone. At the present time there is an extensive research and development program being carried on by several mining companies for the processing and concentrating of taconite and other low-grade iron ores. Several plants for this work have been or are being built in the area.

12. An oil pipeline has been constructed from the oil fields near Edmonton, Alberta, Canada, to Superior, Wis., from where crude oil will be transshipped by boat principally to Sarnia, Ontario, Canada. About 180 tanker trips per season are contemplated. Two very large tankers are being constructed for this service and two others are being obtained. There are unconfirmed reports that a natural gas pipeline is to be constructed to this area from the above-mentioned oil fields.

13. Duluth and Superior are served by eight and six major railroads, respectively. These lines provide convenient connections with other major railway systems of Minnesota, Wisconsin, and other States. These cities also are served by a network of improved Federal and State highways to all the principal communities in the tributary area and to the larger centers of population. Motor bus and truck services are available to all principal surrounding points.

## BRIDGES

14. Table 1 shows the location, dimensions, and other pertinent data for the bridges crossing the waterway at Duluth-Superior Harbor as well as those that cross the St. Louis River downstream from Fond du Lac, Minn. All of these bridges, except the Lamborn Avenue bridge, were constructed under plans approved by the Secretary of War.

TABLE 1.—*Bridges*

| Name | Location | Miles above mouth | Owner | Date of completion | Plans approved by War Department | Use | Type | Clearance in feet [1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Vertical closed | Horizontal normal to channel | | |
| | | | | | | | | | Left | Center | Right |
| Duluth Canal lift bridge | Duluth, Minn., Lake Ave., South. | | City of Duluth, Minn. | June 4, 1930 | June 19, 1928 | Highway | Vertical lift. | 138.7 and 16.5 | | 300 | |
| Duluth and Superior | St. Louis Bay | 5.25 | Duluth & Superior Bridge Co. (Great Northern Ry. Co.). | Apr. 23, 1897, and Sept. 27, 1908 (reconstructed). | Apr. 10, 1895, and Apr. 1, 1907. | Foot, highway, and railway. | Swing | 23.0 | 200 | | 200 |
| Northern Pacific (Wisconsin span). | St. Louis Bay, south channel. | 5.65 | Northern Pacific Ry. Co. | May 22, 1909 | Jan. 22, 1907 | Railway | do | 16.0 | 175 | | 175 |
| Northern Pacific (Minnesota span). | St. Louis Bay, north channel. | 5.72 | do | do | do | do | do | 14.8 | 175 | | 175 |
| Northern Pacific (Grassy Point Bridge). | St. Louis River | 8.00 | do | Oct. 10, 1912 | May 10, 1909, and July 29, 1909. | do | do | 12.00 | 175 | | 175 |
| Arrowhead | do | 8.69 | Arrowhead Bridge Co. | July 3, 1927 | Aug. 19, 1926 | Foot and vehicle. | Bascule | 33.7 | | 211 | |
| Transfer Bridge [2] | do | 16.26 | Interstate Transfer Ry. | Feb. 20, 1911 | Mar. 16, 1908 | Foot, vehicle and railway. | Swing | 22.4 | 125 | | 125 |
| Fond du Lac Bridge [3] | do | 21.32 | St. Louis County, Minn. | May 3, 1921 | June 18, 1918 | Foot and vehicle. | Fixed | 23.93 | | 116 | |
| Lamborn Ave | Howards Bay, Lamborn Ave., Superior, Wis. | | City of Superior, Wis. | Dec. 15, 1890 | | Highway | Swing | 5.00 | 123 | | 123 |

[1] Clearances refer to low-water datum for Lake Superior (601.6 above mean tide at New York).
[2] This bridge is above the existing approved project for this harbor but crosses the stream where it is considered navigable water of the United States.
[3] This bridge is considered as the head of navigable waters at this harbor.

PRIOR AND PENDING REPORTS

15. A total of 34 reports have been submitted for this harbor. Those reports submitted since 1893 are listed in table 2.

TABLE 2.—*Prior reports*

| Document No. | Congress | Session | Date submitted to Congress by Secretary of the Army | Recommendations |
|---|---|---|---|---|
| House, 59 | 53d | 3d | Dec. 4, 1894 | Favorable; recommended general improvement by dredging basins and channels to 20-foot depth, at a cost of $3,130,553. |
| House, 172 | 53d | 3d | Jan. 2, 1895 | Favorable, recommended dredging of Allouez Bay, at a cost of $316,810. |
| House, 215 | 58th | 2d | Dec. 16, 1903 | Unfavorable; pertained to deepening the upper St. Louis River. |
| House, 82 | 59th | 2d | Dec. 3, 1906 | Favorable; recommended improvement of Superior entry by construction of piers and breakwater, at a cost of $1,703,000. |
| House, 221 | 60th | 1st | Dec. 7, 1907 | Favorable; recommended enlargement of Duluth Harbor Basin by dredging, at a cost of $550,800, and dredging approach to Duluth ship canal to 30-foot depth. |
| House, 317 | 61st | 2d | Dec. 10, 1909 | Unfavorable; pertained to enlargement of Superior Harbor Basin. |
| House, 320 | 61st | 2d | do | Unfavorable; pertained to extension of 20-foot channel in St. Louis River. |
| Senate, 439 | 61st | 2d | Mar. 18, 1910[1] | Unfavorable; pertained to extension of dredged channel in St. Louis River. |
| House, 29 | 62d | 1st | Apr. 24, 1911 | Unfavorable; pertained to extension of dredged channel in St. Louis River. |
| House, 162 | 63d | 1st | July 19, 1913 | Unfavorable; pertained to extension of dredged channel in St. Louis River. |
| House, 184 | 63d | 1st | Aug. 5, 1913 | Unfavorable; pertained to extension of dredged channel in St. Louis River. |
| House, 651 | 64th | 1st | Feb. 3, 1916 | Favorable; recommended enlargement of Superior Harbor Basin by dredging an area of 160 acres at a cost of $360,000. |
| House, 1018 | 64th | 1st | Apr. 10, 1916 | Favorable; recommended enlargement of East Gate Basin by dredging an area of 10 acres at a cost of $24,000. |
| House, 1138 | 65th | 2d | May 27, 1918 | Unfavorable; pertained to construction of breakwater opposite Duluth ship canal. |
| House, 245 | 69th | 1st | Feb. 2, 1926 | Favorable; recommended dredging of mouth of Howards Bay at a cost of $8,000. |
| Unpublished report | | | | Unfavorable; pertained to extending deep water channel up St. Louis River to Fond du Lac, Minn. |
| House, 32 | 71st | 2d | Apr. 9, 1930 | Favorable; recommended dredging in Howards Bay at a cost of $36,000. |
| House, 482 | 72d | 2d | Dec. 5, 1932 | Favorable; recommended deepening and widening of basins and channels at a cost of $1,319,000. (See par. 4 for details.) |

[1] Submitted by Chief of Engineers.

16. A flood-control survey scope review report is now under preparation on the St. Louis River, Minn., basin in compliance with a resolution by the Committee on Public Works, House of Representatives, adopted August 16, 1950. That survey report will consider the flood problem at Fond du Lac, Minn. A flood-control preliminary examination report also is under preparation on all streams in Douglas County, Wis., in compliance with section 11 of the Flood Control Act approved July 24, 1946. That report will consider measures to prevent silting at the mouth of the Nemadji River in the Superior portion of the harbor. As referred to in paragraph 2, a final survey review report to consider other navigation improvements of Duluth-Superior Harbor will be submitted in compliance with the resolution adopted July 13, 1949.

ORIGINAL AND EXISTING CORPS OF ENGINEERS' PROJECT

17. *Original project.*—The original project adopted by the River and Harbor Act of March 2, 1867, was for Superior City Harbor

and provided for a rock protection to the beach on Minnesota Point narrowing gradually the outlet of the bay to 350 feet by crib work, constructing two parallel piers composed of stone-filled cribs, the weather pier (Wisconsin) extending to 18 feet depth of water in the lake, all at a total estimated cost of $263,300. There was expended under this project about $258,000.

18. The project adopted by the River and Harbor Act of March 3, 1871, was the first project in which reference was made to Duluth. It provided for the extension of the 400-foot breakwater (originally constructed by the Northern Pacific Railway Co.) by adding 2,622 feet to its length at an estimated cost of about $387,300. This breakwater was abandoned in 1872 after being wrecked by a storm. There was expended under the project of 1871 about $110,000.

19. The project adopted by the River and Harbor Act of March 3, 1873, provided for dredging in the Bay of Superior from the natural entrance to the docks of Superior and Duluth and preserving both lake entrances. The original estimate was about $270,000. The object was to maintain the Superior entrance and the canal built by the city of Duluth and the Northern Pacific Railway Co. and to provide channels within the harbor for vessels to reach the docks of Superior and Duluth. Dredging was to be carried to a depth of 13 feet below low-water datum.

20. The project adopted by the River and Harbor Act of March 3, 1881, provided for the maintenance of the harbors at Duluth and Superior citys and the enlargement of the dredged areas and channels of these harbors by dredging to 16 feet below low-water datum. The River and Harbor Act of July 5, 1884, modified the project of 1881 by adding to the channels to be improved the channel of the St. Louis River within the Bay of Superior. The total estimated cost of this work was about $345,000.

21. The River and Harbor Act of August 5, 1886, further modified the project of 1881 by adding the improvement of St. Louis Bay which provided for the deepening along the dock line on the Wisconsin shore from deep water at Connors Point toward deep water at Grassy Point. The River and Harbor Act of August 11, 1888, further modified the project of 1881 by providing an extension of the new channel along Rices Point and a channel along the north shore of St. Louis Bay at a cost of about $68,000.

22. The River and Harbor Act of July 13, 1892, again modified the act of 1881 and authorized the expenditure of about $45,000 for improving the channel of St. Louis River above Grassy Point.

23. *Existing project.*—The existing project authorized by nine River and Harbor Acts from June 3, 1896, to August 30, 1935, provides for the following work:

(*a*) Rebuilding the canal piers at Duluth entry with stone-filled timber-crib substructure and concrete superstructure 1,734 feet long and 300 feet apart for 1,250 feet, then flaring to 540 feet apart at the harbor end.

(*b*) Replacing the north and south piers at Superior entry with concrete piers 2,096 and 1,584 feet long, respectively, 500 feet apart for 808 feet then flaring at the harbor end.

(*c*) Constructing 4,205 feet of rubble-mound breakwater, 900 feet of concrete pierheads on stone-filled cribs, and 896 feet of concrete shore revetments at Superior entry, the lake ends being 600 feet apart on the 30-foot contour in prolongation of the entrance channel and diverging to 2,100 feet apart at the shore line.

(*d*) A flared-lake approach to Duluth entry 32 feet deep, and a channel between the piers 32 feet deep at the pierheads, gradually decreasing to 26 feet at the harbor basin.

(*e*) A depth of 26 feet in the northern part of the harbor basin inside Duluth entry consisting of 201 acres; a depth of 25 feet in the southern portion of the harbor basin and part of the East Gate Basin; a depth of 22 feet in the remainder of East Gate Basin; and a depth of 22 feet in Superior front channel, through Superior Bay, 600 feet in width, extending to Superior Harbor Basin, a distance of 13,200 feet.

(*f*) A flared-lake approach to Superior entry 32 feet deep; a channel between the breakwater entrance and the pierheads with a width varying from a minimum of 600 feet to a maximum of 1,100 feet, 32 feet deep at the breakwater entrance, gradually decreasing to 28 feet at the pierheads; a stilling basin of 20 acres, 24 feet deep, inside the the breakwater; and a channel between the piers, 28 feet deep at the pierheads gradually decreasing to 25 feet at the harbor basin.

(*g*) A harbor basin of 290 acres, 25 feet deep, inside Superior entry; a channel in Allouez Bay 2,100 feet long, 400 feet wide, and 22 feet deep; a depth of 25 feet in the south channel of St. Louis Bay from the entrance (East Gate Basin) to the cross channel, inclusive, with widths varying from 500 to 900 feet.

(*h*) A depth of 25 feet in a cross channel, with minimum width of 1,150 feet, and a depth of 25 feet in the north channel of St. Louis Bay opposite the cross channel; elsewhere in the north channel and the south channel and the St. Louis River to a point 9,600 feet above the Grassy Point Bridge, a depth of 21 feet, and, except at Arrowhead Bridge, a minimum width of 400 feet; and a channel thence up St. Louis River 20 feet deep and 200 feet wide to Spirit Lake (southerly end of Big Island) a distance of about 14,200 feet.

(*i*) A channel in Howards Bay 6,000 feet long, narrowing in width from 300 to 125 feet, and 21 feet deep; and a channel 3,300 feet long, 100 feet wide, and 20 feet deep at Twenty-first Avenue, West, in Duluth.

24. The existing project was completed in 1935. The following work has been accomplished: Dredging of channels and basins under the existing project was completed in 1935; new piers aggregating 3,468 feet in length, of concrete on stone-filled cribs founded on piles, completed in 1901 at Duluth entry; new piers aggregating 3,680 feet in length, of concrete on piles, completed in 1909 at Superior entry; converging breakwaters comprising 4,205 linear feet of rubble mound, 900 linear feet of stone-filled cribs and concrete superstructure pierheads founded on piles, and 896 linear feet of concrete shore revetments on pile foundations, completed in 1912. All piers and revetments are riprapped. The total cost of permanent work on all projects to and including December 31, 1950, is shown in table 3.

TABLE 3.—*Cost of previous and existing projects*

| Project | New work | Maintenance | Total |
|---|---|---|---|
| Previous projects | $1,547,000 | | $1,547,000 |
| Existing project | 6,857,000 | $3,133,000 | 9,990,000 |
| Total | 8,404,000 | 3,133,000 | 11,537,000 |

The latest (1948) approved estimate of annual cost of maintenance is $140,000. The average cost of annual maintenance during the past 5 years has been about 90 percent of the approved estimate. There are no recommended changes in the project pending before Congress.

### OTHER IMPROVEMENTS

25. Non-Federal improvements which have benefited navigation at Duluth-Superior Harbor have been as follows:

(*a*) In 1870 the city of Duluth and the Northern Pacific Railway Co. jointly expended about $43,800 in cutting the Duluth entry through Minnesota Point.

(*b*) In 1897 the city of Duluth donated lands for the Duluth entry site. These lands cost the city about $12,200.

### TERMINAL AND TRANSFER FACILITIES

26. The following terminal facilities are available in this harbor which is accessible to any vessel operating on the Great Lakes: 7 ore docks, combined length 14,580 feet, combined storage capacity 819,100 long tons; 19 coal docks, combined storage capacity 10,700,000 short tons; 29 grain elevators, on 13 docks, combined storage capacity 58,055,000 bushels; 2 limestone docks (in addition limestone is handled at 4 coal docks); 3 petroleum products terminals, 2 of which use other docks for docking of vessels while discharging; 8 steel and scrap iron docks (in addition steel and scrap iron is handled at 2 coal docks); 1 crude oil and petroleum product shipping terminal under construction with expected yearly shipments over the dock 20,000,000 to 25,000,000 barrels or 3,000,000 to 3,800,000 tons per year; 2 cement elevators (1 at Duluth with storage capacity of 114,000 barrels and 1 at Superior with storage capacity of 70,000 tons. Cement is manufactured at the Superior unit from clinkers received by water over one of the limestone docks); 2 modern terminal and cold storage plants for package and perishable freight; 4 small public wharves, at street ends; and 53 other wharves and docks, a total of 110 wharves and docks.

27. The iron ore docks, coal docks, and a few of the grain elevators are not open to the general public. The other wharves, elevators and terminals are open to the public on equal terms to all. The wharves at street ends are the only publicly owned wharves.

28. The iron ore docks load ore into ships by gravity from storage pockets in their upper portions. Coal is usually removed from boats by trolley type bridges from which large clamshell buckets are operated. Grain is unloaded from boats generally by conveyor or vacuum type unloaders and is loaded into boats by modern spouting systems. There are sufficient freight handling facilities on existing wharves to handle commerce amounting to about 75,000,000 tons annually. The facilities are such that 3 to 4 hours usually suffice to load 12,000 long tons of iron ore and 10 to 12 hours for unloading 10,000 net tons of coal. In 1 day of 10 hours, 350 rail cars of grain have been unloaded and 1,400,000 bushels of grain have been loaded. The loading capacity of the crude oil shipping terminal is expected to be about 24,000 barrels per hour. In a 72-hour period in 1943, 77 vessels with 855,667 gross tons of iron ore were loaded at the Duluth, Missabe & Iron

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Range Railway Co. ore docks. A repair yard with drydocks for deep-draft vessels is located at the inner end of Howards Bay.

29. The harbor frontage behind harbor lines amounts to 49 miles. The harbor frontage occupied by wharves amounts to about 6.7 miles. The harbor area is about 19 square miles, and the length of dredged channels is 17 miles. There is adequate space for development of further terminals in many locations in the harbor which would be accessible from existing channels or basins.

IMPROVEMENTS DESIRED

30. A public hearing was held by the district engineer in the City Hall at Duluth, Minn., on June 13, 1950. About 45 persons were present including the following:

(*a*) Representatives of the Lake Carriers' Association, Cleveland, Ohio; five steamship companies; two railroads; one shipyard; one marine contracting company; and a small-craft yard operator.

(*b*) The mayor, city commissioners, and other city officials of Duluth, Minn.; the city manager and other city officials of Superior, Wis.

(*c*) Representatives of the New Industries Bureau, the Harbor Commission of Superior, and the Chamber of Commerce of Duluth.

(*d*) Representatives of three labor unions and two news agencies.

(*e*) Small-boat owners, several property owners from Fond du Lac, Minn., freighter captains, and other individuals. The stenographic report of the hearing, including related papers, accompanies this report.

31. The improvements listed below were requested by the agencies shown:

(*a*) By the Lake Carriers' Association and endorsed or concurred in by several other agencies and by city officials of Duluth and Superior:

(1) Dredge Superior front channel and all of East Gate Basin to a depth of 25 feet.

(2) Widen channel in East Gate Basin in the vicinity of Rices Point.

(3) Change alinement of the protection piers of the Duluth and Superior bridge to permit a less hazardous passage from East Gate Basin to the south channel through the nearby Wisconsin span of the Northern Pacific Railway Co. bridge.

(4) Widen the Minnesota channel opposite the slip at the Zenith Furnace Co. dock to facilitate movement of vessels using this coal terminal.

(*b*) By the Knudsen Shipbuilding & Dry Dock Co., Superior Harbor Commission, New Industries Bureau of Superior, and others:

(1) Deepen Howards Bay to 25 feet, provide a turning basin at or near the Knudsen Shipbuilding & Dry Dock Co. yard and remove Lamborn Avenue Bridge to benefit vessels using the ship repair facilities.

(*c*) By Farmers Union Grain Terminal Association and New Industries Bureau of Superior:

(1) Dredge approaches to Tower Bay and Hughitt slips in Howards Bay to facilitate navigation.

(*d*) By the Federated Trades Association of Duluth, Minn., and in part by others:

(1) Construct arrowhead breakwaters and reconstruct the piers at Duluth entry.

(2) Deepen Duluth Harbor Basin, East Gate Basin, West Gate Basin, south channel, and cross channel to 27 feet; deepen the channels from the cross channel to the Zenith Furnace Co. dock to 25 feet; and deepen, widen, and straighten the channel from Zenith Furnace Co. dock to Fond du Lac sufficiently to accommodate excursion boats and pleasure craft.

(3) Deepen Superior Harbor Basin and Superior front channel to 27 feet, and Allouez channel to 25 feet.

(4) Widen East Gate Basin for the turn into and away from the Duluth and Superior bridge; revise channel lines in West Gate Basin; widen the south channel and upper channel; and widen the cross channel to 2,400 feet, and Minnesota and Allouez channels to 600 feet.

(*e*) By the Great Northern and the Northern Pacific Railways:

(1) Relief from silt deposits from Nemadji River at their docks in Superior Harbor Basin.

(*f*) By numerous individuals and agencies, including the mayor and commissioners of Duluth and officials of Superior:

(1) Provide a channel for small craft navigation in St. Louis River for distance of about 9 miles to the vicinity of Fond du Lac, Minn.

(2) Relief from the flood situation on the St. Louis River at and in the vicinity of Fond du Lac.

32. The improvements which are under detailed consideration in this interim report comprise the deepening of Superior front channel and widening of the channel at Rices Point in East Gate Basin. Other desired improvements will be considered in the final review report now under preparation and in two flood control reports also under preparation as referred to in paragraphs 2 and 16 herein.

33. Reasons advanced for improvements considered in this interim report are as follows:

(*a*) Deepening of Superior front channel would enable vessels to carry capacity cargoes of iron ore and utilize either the Duluth or Superior entry when either of these entries is inaccessible. Ice conditions in early spring occur practically every year and often in the fall and preclude the use of one of the entries. Also the use of one of the entries could be prevented in the more important summer season by a vessel blocking an entry due to an accident. During severe storms and adverse current conditions it is sometimes necessary that all vessels use the Superior entry due to more favorable entrance conditions.

(*b*) Widening of the channel at Rices Point in East Gate Basin would provide increased safety and convenience by easing the right angle turn for vessels using the iron ore and coal terminals located in the inner Duluth-Superior Harbor.

## COMMERCE

34. Table 4 shows the annual amounts of water-borne commerce of the harbor for the calendar years 1940 to 1949, inclusive, including passenger traffic.

TABLE 4.—*Comparative statement of traffic 1940 to 1949, inclusive*

| Vessel arrivals [1] | | | Receipts (short tons) [2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Number | Net registered tonnage | Coal and coke | Limestone, limestone products and dolomite | Petroleum products | Grains and screenings (including flaxseed) | Iron and steel | Sand and gravel | Automobiles | All other | Total |
| 1940 | 4,861 | 21,527,626 | 7,149,166 | 480,950 | 836,110 | 30,719 | 48,761 | 19,953 | 46,545 | 217,653 | 8,829,857 |
| 1941 | 6,274 | 26,594,432 | 8,664,604 | 568,538 | 767,653 | 46,675 | 123,390 | 26,718 | 45,525 | 234,238 | 10,477,341 |
| 1942 | 6,553 | 28,689,253 | 8,572,348 | 690,183 | 534,431 | 81,062 | 93,395 | 40,554 | 142 | 117,305 | 10,129,420 |
| 1943 | 5,494 | 25,489,592 | 9,845,279 | 474,272 | 501,045 | 794,743 | 56,748 | 23,825 | 95 | 69,951 | 11,765,958 |
| 1944 | 5,383 | 25,211,572 | 9,949,939 | 380,858 | 482,740 | 1,142,828 | 49,431 | 25,203 | 133 | 66,930 | 12,098,062 |
| 1945 | 5,069 | 24,768,852 | 8,911,763 | 655,843 | 565,335 | 537,346 | 35,128 | 36,058 | 160 | 64,548 | 10,806,181 |
| 1946 | 4,093 | 19,631,537 | 10,102,616 | 827,145 | 781,635 | 151,266 | 45,926 | 43,692 | 15,111 | 75,961 | 12,043,352 |
| 1947 | 4,972 | 23,921,087 | 9,696,891 | 745,867 | 266,000 | 98,762 | 46,499 | 45,157 | 25,589 | 60,103 | 10,984,868 |
| 1948 | 5,452 | 25,888,455 | 9,857,446 | 861,559 | 355,148 | 110,500 | 50,987 | 43,472 | 36,538 | 55,547 | 11,371,197 |
| 1949 | 4,613 | 22,577,094 | 5,039,623 | 909,512 | 363,746 | 196,354 | 62,357 | 27,890 | 55,230 | 67,923 | 6,722,635 |
| Annual average | 5,276 | 24,429,950 | 8,778,968 | 659,473 | 545,384 | 319,026 | 61,262 | 33,252 | 22,507 | 103,016 | 10,522,887 |

| Vessel departures [1] | | | Shipment (short tons) [2] | | | | | | | | Total receipts and shipments (short tons) | Passengers, arrived and departed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Number | Net registered tonnage | Iron ore | Grains and flaxseed | Iron and steel except scrap | Iron and steel scrap | Flour | Dairy products | Manganese ore | All other | Total | |
| 1940 | 4,860 | 21,516,764 | 41,883,284 | 2,294,448 | 149,002 | 428,209 | 196,405 | 77,652 | ---------- | 288,838 | 45,317,838 | 54,147,695 | 12,594 |
| 1941 | 6,279 | 26,602,193 | 53,486,823 | 2,801,812 | 177,361 | 279,522 | 168,985 | 77,008 | ---------- | 294,144 | 57,285,655 | 67,762,996 | 32,717 |
| 1942 | 6,547 | 28,666,542 | 61,533,574 | 2,114,453 | 121,713 | 223,478 | 73,916 | 29,211 | ---------- | 88,881 | 64,185,226 | 74,314,646 | 29,846 |
| 1943 | 5,545 | 25,557,967 | 54,426,103 | 2,128,995 | 94,708 | 198,363 | ---------- | ---------- | ---------- | 42,662 | 56,890,831 | 68,656,789 | 23,395 |
| 1944 | 5,397 | 25,234,616 | 51,285,571 | 3,472,632 | 193,370 | 96,010 | 7,400 | ---------- | ---------- | 35,813 | 55,090,796 | 67,188,858 | 25,845 |
| 1945 | 5,072 | 24,765,019 | 49,401,791 | 4,836,690 | 175,338 | 152,563 | ---------- | ---------- | ---------- | 38,160 | 54,604,562 | 65,410,743 | 23,652 |
| 1946 | 4,090 | 19,620,244 | 38,632,166 | 3,325,481 | 106,938 | 79,584 | ---------- | ---------- | 58,227 | 39,637 | 42,242,033 | 54,285,385 | 19,415 |
| 1947 | 4,978 | 23,940,317 | 50,092,949 | 3,091,457 | 131,620 | 70,184 | ---------- | ---------- | 58,198 | 28,237 | 53,472,645 | 64,457,513 | 58,962 |
| 1948 | 5,453 | 25,882,837 | 54,175,877 | 3,361,037 | 113,382 | 127,199 | ---------- | ---------- | 60,325 | 33,387 | 57,871,207 | 69,242,404 | 79,625 |
| 1949 | 4,607 | 22,521,448 | 45,504,161 | 4,124,786 | 93,895 | 134,297 | ---------- | ---------- | 32,006 | 62,121 | 49,951,266 | 56,673,901 | 19,609 |
| Annual average | 5,283 | 24,430,800 | 50,042,230 | 3,155,179 | 135,733 | 178,943 | [3] 111,677 | [3] 61,290 | [3] 52,189 | 95,188 | 53,691,206 | 64,214,093 | 32,566 |

[1] Excludes the following: Commercial fishing vessels which averaged 785 trips per year for the period; Government operated vessels which averaged 51 trips in-bound, and 63 out-bound for the period; and recreational craft.

[2] Includes autos, accompanying passengers until 1948. Total of 424 units in 1948, and 512 units in 1949.

[3] Average of the years in which traffic occurred.

35. During the years 1940 to 1949 inclusive, the freight traffic of this port has varied from a minimum of 54,147,695 tons in 1940 to a maximum of 74,314,646 tons in 1942, the annual average during the period having been 64,214,093 tons. The general trend for various items of commerce is as follows:

(*a*) Receipt of—

(1) Coal and coke has been reasonably uniform except for the year 1949 when a decrease of about 43 percent below average occurred.

(2) Limestone and limestone products has increased materially since 1945.

(3) Petroleum products shows a general decrease during the past 3 years.

(4) Grains and screenings fluctuate widely.

(5) Iron and steel is generally stable with only a few years departing very far from average.

(6) Automobiles have increased rapidly since 1945.

(7) Other commodities have remained generally stable for the past 7 years but show a substantial reduction since 1942.

(*b*) Shipment of—

(1) Iron ore is generally stable except when affected by the length of the shipping season or other hindering conditions, such as strikes.

(2) Grains and flaxseed shows only minor variation although there is some increase since 1944.

(3) Iron and steel, except scrap, shows a general reduction during the past 4 years.

(4) Iron and steel scrap varies widely so that a general trend is difficult to observe.

(5) Flour and dairy products has shown fundamentally no activity since 1943.

(6) Manganese ore has developed in small quantities since 1946.

(7) Other commodities have shown little variations since 1943 except for the year 1949 when a substantial increase occurred. During these past 7 years there is a substantial decrease from shipments occurring during 1941 to 1943, inclusive.

36. (*a*) *Iron ore.*—The iron ore shipped from Duluth-Superior Harbor has averaged about 50,000,000 tons annually for the past 10 years and has comprised about two-thirds of all the iron ore which has been shipped from Lake Superior ports. There is considerable fluctuation from year to year in the estimated iron ore reserves of the Lake Superior district. The high grades of iron ore remaining in the various Lake Superior ranges as of 1946 are reported to be at least 1,347,000,000 short tons. At an estimated annual production of 70 million short tons of high grade ore the life of these ranges becomes about 20 years. The leaner ores from the Mesabi Range, near Duluth-Superior Harbor, also will be required to mix with the high grade ore from foreign sources. Further explorations and improved ore reduction and handling methods may materially increase the economically usable reserves. Nearly all the steel companies are actively engaged in a search for new foreign iron ore and some are working on improved methods for using the taconite ores of the Lake Superior district. Therefore, the iron ore commerce at Duluth-Superior Harbor is expected to remain generally stable for many

years. The reduction in shipment and receipt of other commodities and shipments of flour and dairy products has resulted from discontinuance of coastwise package freight business early in World War II because of removal of these boats for other urgent uses. It is expected that the reduction in the receipt of coal during 1949, which was due primarily to strikes, is not indicative of a substantial trend. Receipt of limestone and limestone products is expected to remain stable or increase slightly from that indicated by 1946 through 1949, principally because of some enlargement of steel making facilities at the head of the Lakes, the establishment of a new cement and lime processing plant in Superior, Wis., and the transshipment of agricultural limestone. Receipt of petroleum products will probably not show any substantial increase because of establishment of crude oil handling facilities and refineries in Superior, Wis.

(*b*) *Other commerce.*—The shipment of grains and flaxseed will probably show some increase as the elevator capacity at the harbor is being substantially increased at the present time. Shipment of iron, steel, and scrap will very likely continue at its present varying quantities. There are indications that the packaged freight trade will be reestablished at this port which undoubtedly would result in a return of the commerce in flour, dairy products, and other packaged freight commodities. A terminal for the shipment of crude oil has been constructed in Superior, Wis., and oil is now being received at the storage farms for shipment principally to Sarnia, Ontario, starting in the spring of 1951. It is expected that during the first year, shipments in this trade will amount to about 2,000,000 tons and eventually increase to over 3,000,000 tons per year. A tank farm having a capacity of 1,800,000 barrels has been constructed, and at least one additional farm with greater capacity is planned for construction in 1951. Passenger traffic will undoubtedly decrease because of removal of one large boat from this trade due to its destruction by fire.

37. The distribution of commerce in 1949 to and between existing terminals is shown on the flow charts [1] accompanying this report. The commerce for 1949 is generally representative of its recent and present character except for the receipt of coal which was about 3,700,000 tons less in 1949 than the average for the 10 previous years and about 5,000,000 tons less than the average for the 3 previous years.

## VESSEL TRAFFIC

38. The harbor is regularly used by the largest vessels on the Great Lakes. Vessels are typical iron ore, coal, and stone bulk carriers, oil tankers, and self-unloaders. They vary in length from about 350 feet to a maximum of 678 feet. The number of over-all lengths of United States registry vessels using the harbor includes about 100 from 600 to 678 feet long, about 36 from 550 to 600 feet long, and about 60 from 500 to 550 feet long. About five Canadian vessels over 600 feet long and eight from 550 to 600 feet long use the harbor at intervals. In addition to the above there are at least 15 similar vessels being built or projected on the Great Lakes to have over-all lengths from 640 feet to 690 feet. Beams of the larger type vessels are generally from 64 to

[1] Not printed.

70 feet. The trend is definitely toward larger vessels. Also being built by Canadian interests are two tankers each to be about 620 feet long, 68-foot beam and 26-foot allowable draft for the newly developing crude oil trade between Superior, Wis., and Sarnia, Ontario, Canada.

39. As shown in table 4, paragraph 34, from 1940 to 1949, inclusive, there were on the average 5,276 large vessel arrivals and about the same number of departures from the harbor annually. Table 5 shows statistics on commercial vessel traffic at Duluth-Superior Harbor during 1949. Data on recreational vessel traffic is not included in this interim report as the improvements being considered would have no effect on such traffic.

TABLE 5.—*Commercial vessel traffic at Duluth-Superior Harbor, 1949*

| Draft, feet | In-bound [1] | | | | Out-bound [2] | | | |
|---|---|---|---|---|---|---|---|---|
| | Steamers | Motor vessels | Barges | Total | Steamers | Motor vessels | Barges | Total |
| 22 to 24 | 7 | | | 7 | 1,089 | 21 | | 1,110 |
| 20 to 22 | 44 | | | 44 | 2,358 | 21 | 24 | 2,403 |
| 18 to 20 | 824 | 1 | 5 | 830 | 716 | 4 | 15 | 735 |
| 16 to 18 | 1,983 | 42 | | 2,025 | 77 | 2 | 1 | 80 |
| 14 to 16 | 1,482 | 14 | | 1,496 | 95 | 4 | 1 | 100 |
| 12 to 14 | 59 | 1 | | 60 | 58 | 5 | | 63 |
| Less than 12 | 45 | [3] 587 | 74 | 706 | 45 | [3] 588 | 38 | 671 |
| Total | 4,444 | 645 | 79 | 5,168 | 4,438 | 645 | 79 | 5,162 |
| Total net registered tonnage | 22,075,869 | 318,270 | 189,743 | 22,583,882 | 22,020,223 | 318,270 | 189,743 | 22,528,236 |

[1] Excludes 69 trips of Government-operated vessels (56 motor vessels, 2 barges, and 11 other) with total tonnage of 32,894.
[2] Excludes 70 trips of Government-operated vessels (57 motor vessels, 2 barges, and 11 other) with total tonnage of 33,269.
[3] Includes 555 trips of commercial fishing vessels.

40. The advantage to water-borne transportation of a depth of 25 feet as compared to the present depth of 22 feet in the Superior Front Channel is dependent on the ability of the bulk cargo fleet to utilize such additional depth. The available drafts in channels and harbors on the Great Lakes as recommended by the Lake Carriers' Association allow, in the case of earth channels, one and one-half feet for squat, variations in water level and other possibilities. Thus boats required to use a channel having a depth of only 22 feet would undoubtedly load to a draft of not more than 20.5 feet. Table 6 shows a classification of United States ore-carrying vessels broken down by increments of allowable emergency summer draft as determined by vessel characteristics. For 8 of the past 9 years, bulk cargo vessels on the Great Lakes have been authorized by the United States Coast Guard to load to this emergency summer draft when channel conditions permit. The additional draft permitted by the emergency summer draft is three-tenths of an inch for each foot of normal draft. About 90 percent of the vessels using this harbor are allowed an emergency summer draft of 20½ feet or more, and about 75 percent are allowed a similar draft of 21 feet or more. The list does not include about 15 Canadian

vessels that are allowed a draft of 21 feet or more that make use of the harbor.

TABLE 6.—*Number of vessels and allowable emergency summer drafts*

| Number of vessels: | *Allowable emergency summer draft in feet* |
|---|---|
| 34 | Less than 20½. |
| 44 | 20½ to 21. |
| 148 | 21 to 22. |
| 61 | 22 to 23. |
| 4 | 23 to 24. |
| 21 | 24 to 25. |
| 1 | More than 25. |

The additional cargo of iron ore which could have been carried in vessels during the periods of ice blockade of Superior entry during 1948–50, if the Superior Front Channel had been deepened to 25 feet, is discussed in the following paragraph.

DIFFICULTIES ATTENDING NAVIGATION

41. The primary difficulty attending navigation at Duluth-Superior Harbor is the consequence of a blockade for any appreciable time during the navigation season by ice or vessel accident of either Duluth entry or Superior entry. In event of such a circumstance, a large number of iron ore carrying vessels must use Superior Front Channel when leaving Duluth-Superior Harbor, and because of the restricted project depth of 22 feet in this channel, there results a situation where vessels cannot load to the full extent permitted by the capacity of the vessel or by controlling navigating conditions in the connecting channels of the Great Lakes and the ore-receiving harbors. Blocking of Superior entry with ice at a time when Duluth entry is open for vessel passage occurs almost every spring. There are similar occasions when vessel operators must use Superior entry due to adverse ice, wave action or current conditions at Duluth entry. Available records are summarized in table 7 which indicate the effect on the ore-carrying capacity of blockade by ice during 1948, 1949, and 1950.

TABLE 7.—*Effect on cargo tonnage during ice blockade, 1948–50*

| Period | Entry blocked by ice | Number of vessels affected | Cargo, tons | | Underload of cargo due to blockade, tons | |
|---|---|---|---|---|---|---|
| | | | Normal allowable | Actual | Total | Per vessel |
| Apr. 7–11, 1948 | Superior | 23 | 301,400 | 270,500 | 30,900 | ---------- |
| Mar. 29–Apr. 15, 1949 | do | 79 | 913,200 | 830,700 | 82,500 | ---------- |
| May 7–18, 1950 | do | 51 | 606,900 | 593,400 | 13,500 | ---------- |
| 3-year total | | 153 | 1,821,500 | 1,694,600 | 126,900 | ---------- |
| 3-year average | | 51 | ---------- | ---------- | 42,300 | 830 |

The above data indicate that in order to operate the vessels safely in the Superior Front Channel with its present limited depth of 22 feet there was an average underloading, using the normal allowable draft, of more than 800 tons of iron ore per vessel due to blockade of

Superior entry by ice. A more serious effect on the ore-carrying capacity of the vessels would result from a blockade of one of the entries due to a vessel accident during the summer portion of the navigation season when the vessels are loaded to the emergency summer draft, which has been authorized by the Coast Guard 8 out of the past 9 years. In such an event the average underloading of iron ore per vessel is estimated to be about 1,200 tons or about 50-percent more than the underloading early in the navigation season. A vessel grounded inside the Superior breakwater in November 1948 and caused a 2-day blockade of the Superior entry. Although this vessel only partially blocked the Superior entry, operators of 18 vessels destined for Duluth-Superior Harbor preferred not to attempt passage and made entry through the Duluth entry. However, it is not difficult to realize that a similar accident could easily result in more serious blocking of either harbor entrance. In addition, there have been numerous near accidents at the Duluth ship canal, and vessels customarily avoid that entrance during storm conditions. On occasions vessels have started to enter and to avoid hitting the piers have been forced to circle out into the lake again and either make another attempt to navigate through the Duluth canal or enter at Superior entry. Also there are serious reversing current conditions in the Duluth entry which make it difficult for vessel operators to approach the entrance with safety particularly during storms or seiches on Lake Superior. Under such conditions vessel operators prefer to use the Superior entry.

42. Although no damage of record has occurred to vessels at Rices Point operators complain of inadequate clearance especially in passing another vessel. There are between 6,000 and 8,000 deep-draft vessel trips annually between Duluth Harbor Basin and West Gate Basin. This vessel traffic is required to make a right-angle turn in a channel at this point having a minimum width of about 1,100 feet. In passing, it is necessary for the out-bound vessel to crowd the west bank, which is undesirable. The additional maneuvering area which readily can be made available would alleviate this condition which is dangerous for the large vessels now in use.

## PLAN OF IMPROVEMENT

43. The plan of improvement considered in detail in this interim report and shown on the accompanying map pertains only to Superior Front Channel and East Gate Basin at Rices Point. The other requested navigation improvements are to be considered in a final review report as stated in paragraph 2.

44. Part A is the proposed plan of improvement of the Superior Front Channel including a portion of the East Gate Basin. It provides for an increase in project depth from 22 feet to 25 feet in order to accommodate the existing and prospective traffic that requires a depth of 25 feet in the event that either the Superior entry or Duluth entry is blocked. The existing project widths of this portion of the harbor are adequate and no change is contemplated. Additional width toward the east in East Gate Basin can be provided by local interests as has been done progressively in the past under permit. At the present time maintenance dredging has been carried as far as the irregular line shown on the accompanying map and can be carried

eastward to the line marked "Limit of project for maintenance." This arrangement is satisfactory to local interests.

45. Part B is the proposed plan of improvement for widening of East Gate Basin at Rices Point. As shown on insert A of the accompanying map, the project line would be moved shoreward a maximum of 170 feet for about 2,000 feet along the channel. A slight shoreward movement of the established harbor line also would be required, as shown in insert A of the map. The project depth would be 25 feet, the same as is authorized for the adjacent portion of East Gate Basin.

46. Provision of necessary land for disposal of dredged materials pertinent to the plan of improvement has been discussed with local interests who have signified their willingness to provide such land when and if the proposed improvements are authorized.

## AIDS TO NAVIGATION

47. No changes in aids to navigation are contemplated in the considered plan of improvement except for part B in East Gate Basin at Rices Point. At this locality it will be necessary to move the existing buoys shoreward to mark the location of the proposed channel line. The United States Coast Guard was consulted and concurs in this proposed change which will not increase the cost of such aids.

## SHORE LINE CHANGES

48. The improvements recommended herein are within the existing Duluth-Superior Harbor, therefore no change would result on Lake Superior shore lines from erosion or accretion. Further, the considered improvements would have no adverse effect on the shore line within the harbor.

## ESTIMATES OF FIRST COST

49. The estimated first cost of recommended work is shown in appendix I [1] and table 8. Unit costs were arrived at after consultation with contractors, consideration of prices and production on several million cubic yards of hydraulic and dipper dredging done in this district since 1933 and the existing price structure. The amounts shown are all Federal costs and include allowances for contingencies, engineering and overhead.

TABLE 8.—*Estimates of first cost* [2]

| *Item* | *Amount* |
|---|---|
| Part A: Deepen Superior Front Channel, and a portion of East Gate Basin at Rices Point to 25 feet depth as shown on map by dredging 1,250,000 cubic yards place measurement of sand, mud, silt and a small boulder area at $0.45 per cubic yard (includes 1 foot overdepth) | $562, 500 |
| Part B: Widen East Gate Basin to 25 feet depth, as shown on map, by dredging 87,000 cubic yards place measurement of sand, mud, silt and sawmill debris at $0.80 per cubic yard (includes 1 foot overdepth) | 69, 600 |
| Total Federal first cost | 632, 100 |

[1] Not printed.

[2] Non-Federal land and disposal easement costs considered to be negligible as the land to be dredged is submerged and of low value, and as no adverse effect to land will result from contemplated disposal of dredged materials.

ESTIMATES OF ANNUAL CHARGES

50. The estimated economic costs for the items of the recommended improvements in this interim report are shown in table 9.

TABLE 9.—*Estimates of annual charges*

| | Part A | Part B |
|---|---|---|
| (*a*) Federal investment: | | |
| 1. Estimated first and investment cost to the United States | $562,500 | $69,600 |
| (*b*) Federal annual charges: | | |
| 1. Interest at 3 percent on Federal investment | 16,900 | 2,100 |
| 2. Amortization on 50-year basis, 0.887 percent on Federal investment | 5,000 | 600 |
| 3. Increase in maintenance | 0 | 0 |
| 4. Total Federal Annual Charges | 21,900 | 2,700 |
| (*c*) Non-Federal first and annual cost | None | None |

ESTIMATES OF BENEFITS

51. The estimated principal tangible benefits and the intangible benefits which would result from each part of the plan of improvement are enumerated below:

52. *Part A.*—If the Duluth entry were blocked, all vessels entering or leaving the harbor would have to use Superior entry and those desiring access to the Duluth portion of the harbor would have to navigate through Superior Front Channel. Sould Superior entry be blocked it would be necessary for all vessels to enter through the Duluth Canal and those desiring access to Superior portion of the harbor would have to be navigated through a portion of East Gate Basin and Superior Front Channel. The principal vessels that would be affected because of reduced drafts would be those loaded with iron ore. Although records of ice blockades at the Superior entry only are readily available for the past 3 years, as shown in table 7, paragraph 41, such conditions generally occur early in the navigation season every year either at the Superior entry or at the Duluth entry. The period of blockade varies due to the amount of ice on Lake Superior, wind direction and the date of opening of navigation. Based on the data in table 7, there is an average annual blockade at either the Superior entry or the Duluth entry for a period of 12 days with a resultant underloading of about 42,300 tons of iron ore for the 51 vessels involved based on allowable drafts. Due to strict control in mixing and blending to produce a predetermined shipping grade of iron ore it is impracticable to partially laod a vessel at one end of the harbor and complete loading to its capacity at the other end. If the Superior Front Channel were deepened to 25 feet the ore carriers could have loaded to the allowable draft during the period of blockade and there would have been a resultant saving of about 4 vessel trips per year. Using an average speed of 11.5 miles per hour when loaded and 12.7 miles per hour when light, an average ore carrier consumes about 145 hours in making a round trip between Duluth-Superior Harbor and a typical harbor on the lower Lakes. As the hourly rate of operation is about $75, the cost to make a round trip is about $10,875. Therefore, the additional cost due to transporting four extra cargoes, or the monetary transportation savings which can be credited to part A of the improvement plan is $43,500. A blockade later in the navigation season when vessels are loaded to the allowable sum-

mer emergency draft would increase the benefit about 50 percent. During a navigation season when all vessels load to the maximum allowable draft and make the maximum number of trips it would be physically impossible to transport in the available vessels the tonnage lost by underloading. In order to make this ore available to the steel mills on the lower Lakes it would be necessary to transport that tonnage by rail at an increased cost. This in effect would result in even a greater benefit to part A of the improvement plan. In the event that either entrance should be blocked while loaded vessels were in the portion of the harbor from which deeply loaded vessels normally are dispatched through the blocked entrance, unloading of part of the cargo at considerable expense would be necessary before such vessels could leave via the existing Superior Front Channel and the open entrance.

53. An important intangible benefit that would result from part A of the improvement plan is that vessel operators for added safety and convenience, particularly in bad weather, prefer to use the wider Superior entry which also has less intense currents. More use would be made of this entry if part A of the improvement plan is provided.

54. *Part B.*—There are between 6,000 and 8,000 deep-draft vessel trips passing Rices Point annually in making the passage through the Duluth and Superior bridge to the docks upstream. The Lake Carriers' Association has stated that under existing conditions navigation by the large vessels is hazardous because of lack of sufficient maneuvering room on the inside of this turn, and the association recommends that additional dredging be undertaken to widen the turn at Rices Point. The proposed widening of the channel at Rices Point would effectively improve the navigating conditions. The resulting benefits to the established important water-borne traffic is considered to be at least equal to the annual cost of the channel widening. The resulting increased safety and convenience to commerce amply justifies the cost of the work.

### COMPARISON OF BENEFITS AND COSTS

55. The following is a summarization of the above estimated annual costs of the parts of the imprvement plan compared to the estimated benefits which would result from both parts of the plan considered herein.

| Plan | Total annual charges | Total annual benefits | Benefit-cost ratio |
|---|---|---|---|
| Part A | $21,900 | $43,500 | 2.0:1 |
| Part B | 2.700 | [1] 2,700 | 1:1 |
| Total parts A and B | 24,600 | 46,200 | 1.9:1 |

[1] Minimum benefit.

### PROPOSED LOCAL COOPERATION

56. Due to the general benefits to be derived from the plan of improvement considered in this interim report local cooperation should be limited to providing without cost to the United States all necessary lands, including disposal areas, easements, and rights-of-way

for the construction and maintenance of the project when and as required, and release of the United States from damages due to the construction work. The mayors of Duluth, Minn., and Superior, Wis., have indicated that the prescribed local cooperation will be furnished.

ALLOCATION OF COSTS

57. The entire first cost for the proposed plan of improvement in the amount of $632,100 is allocated to the United States. There would be no increase in the annual cost of maintenance due to the improvements proposed herein.

COORDINATION WITH OTHER AGENCIES

58. The Lake Carriers' Association was consulted and concurs in the proposed plan of improvement for deepening of Superior Front Channel and East Gate Basin and for widening at Rices Point.

59. The city council of Duluth, Minn., was consulted concerning dump areas along Minnesota Point for disposal of material from dredging in Superior Front Channel and East Gate Basin, and the proposed change in the harbor line which would result because of the widening at Rices Point. The councilmen were noncommital regarding the depth in Superior Front Channel and East Gate Basin but did urge that this channel be deepened. They indicated that the city would furnish the necessary dumping easements for disposal of material insofar as required in the Duluth portion of the harbor. They indicated also their concurrence in the proposed harbor line change at Rices Point. The Board of County Commissioners of St. Louis County, Minn., was consulted and concurs in the proposed change of the harbor line at Rices Point.

60. The city manager and others of the Superior, Wis., city government were consulted and expressed concurrence in the plan of improvement for deepening of Superior Front Channel and East Gate Basin. They propose to cooperate in providing disposal areas for dredged material.

61. The representatives of the States of Minnesota and Wisconsin were advised of the nature of the plan of improvement recommended in this interim report, and were requested to submit such comments as desired. No comments from the States have as yet been received. The United States Coast Guard was consulted concerning the proposed improvements as stated in paragraph 47 above.

DISCUSSION

62. Duluth-Superior Harbor, Minn. and Wis., lying at the westerly end of Lake Superior, handles the largest tonnage of any harbor on the Great Lakes and is second only to New York Harbor in average total tonnage handled in any harbor in the United States. During the period 1940 through 1949, inclusive, the total receipts and shipments averaged 64,214,000 tons per year, reaching a peak in 1942 of 74,314,000 tons. Shipments consist largely of iron ore with substantial amounts of grain and lesser amounts of iron and steel products, steel scrap and other commodities. Receipts consist principally of coal and coke, with lesser amounts of limestone and limestone products,

petroleum products, grain, iron and steel, and other miscellaneous items. The average number of vessel arrivals and vessel departures during the above-mentioned 10-year period was 5,276 and 5,283 respectively, excluding commercial fishing vessels, Government operated vessels, recreational craft, and other similar craft, with a maximum in 1942 of 6,553 arrivals and 6,547 departures. The harbor is accessible to any vessel operating on the Great Lakes and is regularly visited by the largest type of lake freighters. There are two entrances to the harbor, the Duluth entry being near the northerly limits of the harbor basin at Duluth, Minn., and the Superior entry being near the southerly end of the harbor opposite Superior, Wis. Excluding Government operated vessels and small craft used for recreation and fishing, about 56 percent of the vessels entered or departed from Duluth Canal and 44 percent from Superior entry during the period 1940 through 1949, inclusive.

63. There are ample terminal and transfer facilities in the harbor with adequate space for additional terminals if necessary. It has been stated that the harbor facilities and protected area at Duluth-Superior Harbor constitute one of the most efficient harbors in the world. Under the existing project, depths of 25 feet or more exist at locations exposed to wave action in what is known as the northerly ore route from the Duluth entry through Duluth Harbor Basin, a portion of East Gate Basin, West Gate Basin, a part of the South Channel and the Cross Channel to the Duluth, Missabe & Iron Range Railway ore docks, and similar depths exist in the southerly ore route through the Superior entry and in Superior Harbor Basin to the Great Northern and Northern Pacific Railway iron-ore docks. Depths in other channels are generally 22 feet where grain ships are handled, and 21 feet where coal and other commodities are carried. Under the existing project, Superior Front Channel and a portion of the East Gate Basin have a project depth of only 22 feet. This channel and basin form the harbor connection between the northerly ore route and the southerly ore route and must be used by a portion of the iron ore vessels during periods when one of the harbor entrances is blocked and the other is open.

64. *Superior front channel.*—Vessel interests desire the deepening of Superior Front Channel and East Gate Basin to a depth of 25 feet to correspond with available depths in the northerly and southerly ore routes in the harbor. The depth of 25 feet available for use by iron-ore vessels at Duluth-Superior Harbor is also equivalent to the depth provided in the connecting channels of the Great Lakes and at the ore-receiving harbors on the lower Great Lakes. The principal reason for the requested channel deepening is that in the event of blockage of either entrance by ice, a sunken vessel, or other eventuality, the vessels loading iron ore and crude oil on the same side of the harbor as the blocked entrance would be required to use the entrance at the opposite end of the harbor. This necessitates navigating through the above-mentioned channel and basin with its present limited depth of 22 feet. Because of the lack of depth in the Superior Front Channel practically all vessels using that channel would be restricted in loading to less than their allowable draft. The data given in paragraph 52 shows that transportation savings in the important traffic in iron ore during periods when ice conditions blocked one of the entrances would amount to about $43,500 annually as a result of deepening the Superior

Front Channel. Additional transportation savings would also result during periods when storms created unsafe sailing conditions through one entry when the other entrance could be used safely. Under emergency requirements for moving the maximum tonnage of iron ore during a navigation season the lost capacity of the iron ore fleet estimated at 42,300 tons annually would be a matter of considerable importance. As there is no satisfactory economical alternate method for transporting equivalent tonnages of iron ore to the steel-producing centers, it is important that such losses be eliminated in time of a national emergency. Such losses could be minimized and largely avoided if the Superior Front Channel and a portion of the East Gate Basin were deepened as proposed so that fully loaded vessels could use either entrance. Greater convenience and safety to operators of vessels using this harbor and corresponding intangible benefits would result if the deeper channel proposed under this portion of the improvement plan is provided, as such operators frequently prefer to use the Superior entry which is wider and subject to less intense currents commonly prevalent at the Duluth entry.

65. Navigation interests concur that the existing width of 600 feet in Superior Front Channel is adequate even in the event of added traffic. There appears to be little question but that to insure that the full capacity of the ore-carrying fleet may be used in an emergency, the Superior Front Channel and all of the East Gate Basin, should have a depth of 25 feet, the same as the northerly and southerly ore routes. The estimated first cost of providing such a depth is $562,500 and based on tangible benefits is economically justified. Local interests have indicated that they will provide the necessary lands and easements for the disposal of dredged material. Due to the national character of commerce in this harbor and the general benefit that would result the entire cost of doing this work should be borne by the United States.

66. *Widening at Rices Point.*—Vessel interests desire widening at Rices Point easterly of the Duluth and Superior bridge in order that boats will have additional area for maneuvering when making the turn from Duluth Harbor Basin into East Gate Basin and vice versa. They contend that additional space would be valuable when making this turn, especially when two boats are passing at or near this point. The widening would start about 750 feet easterly of the Duluth and Superior bridge, the maximum additional width would be about 170 feet, and it would extend to a point opposite the start of the flare at the southerly end of Duluth Harbor Basin, as shown on the map accompanying this report. The Lake Carriers' Association has concurred in the widening recommended in lieu of that which it suggested which would start at the same point, have maximum width of almost 300 feet and end some 400 feet southerly of the widening recommended. The recommended widening would involve dredging approximately 87,000 cubic yards of material at an estimated cost of about $69,600 whereas the alternate widening would involve dredging some 168,000 cubic yards of material at a probable cost of about $135,000. The principal benefit to be derived from this part of the improvement plan would be increased safety and convenience to the 6,000 to 8,000 vessel trips per year which pass this point by providing additional maneuvering area. The minimum monetary value of the benefit resulting from the proposed widening is considered to be sufficient to provide eco-

nomic justification for the proposed work. A change in the harbor line along this reach of channel will be involved. The St. Louis County commissioners, who are custodians for the State of Minnesota for tax-forfeited property, and the city of Duluth were consulted concerning this change in the harbor line and the widening at this point. They have indicated that the necessary lands can be made available without cost to the United States so that the harbor line may be changed. All expenses in connection with this widening except that necessary to supply the above-mentioned local cooperation should be borne by the United States because of the national character of traffic and its huge volume at this particular point.

67. It appears pertinent in discussion of this harbor to emphasize the desirability of encouraging vessel operators to moor a greater number of bulk carriers at this harbor during the winter months than has been done in recent years. In the event of failure of the locks at Sault Ste. Marie, with the majority of the bulk carriers on the lower Lakes, it would not be possible to utilize to the fullest extent a suggested method of moving iron ore via vessels to some point along the south shore of Lake Superior, then transshipping it across the upper peninsula of Michigan for ultimate shipment via other vessels to the ports on the lower Lakes. It is believed that due to the extreme importance of iron ore in our national economy and since the Mesabi Range is at the present time the most critical source of supply, further study should be made of this situation. A preliminary examination report on alternate routes between Lake Superior and waters of the lower Great Lakes has been authorized by resolution of the Committee on Rivers and Harbors of the House of Representatives adopted April 5, 1949. A report on this examination was submitted to the Chief of Engineers December 15, 1950.

## CONCLUSION

68. It is considered to be in the public interest for the United States to deepen the Superior Front Channel and a portion of the East Gate Basin and to widen the East Gate Basin, parts A and B, respectively, of the improvement plan, subject to certain items of local cooperation. Part A of the plan is economically justified by savings in cost of transportation and from the standpoint of national security is necessary in the event that either the Duluth entry or the Superior entry is blocked for an appreciable period as it is essential that a continuous flow of iron ore be maintained via vessel between Duluth-Superior Harbor and the lower Lake ports throughout the navigation season. Part B of the plan is justified by increased safety to navigation for 6,000 to 8,000 vessel trips passing annually between East Gate Basin and West Gate Basin.

69. The estimated cost to the United States for deepening the Superior Front Channel and a portion of East Gate Basin, part A of the improvement plan, is $562,500 and for widening East Gate Basin, part B, $69,600, making a total of $632,100. All of the funds should be made available in one allotment as both parts of the plan are of about equal importance. All of the dredging can be accomplished in 1 year and should be done under one contract in order to obtain the lowest unit cost for the dredging.

RECOMMENDATIONS

70. It is recommended that the existing project for Duluth-Superior Harbor, Minn. and Wis., be modified to provide:

(*a*) That Superior Front Channel and the portion of East Gate Basin Channel which has an existing project depth of 22 feet be deepened to 25 feet, about as shown on the accompanying map, at an estimated first cost to the United States of $562,500, with no increased cost in annual maintenance.

(*b*) That East Gate Basin at Rices Point be widened a maximum of 170 feet for a distance of about 2,000 feet along the channel with a depth of 25 feet, about as shown on the accompanying map, at an estimated first cost to the United States of $69,600, with no increased cost in annual maintenance.

It is recommended further that these modifications of the project shall be subject to the condition that local interests give assurances satisfactory to the Secretary of the Army that they will:

(*a*) Provide without cost to the United States all necessary land, easements, and rights-of-way for the construction and maintenance of the project when and as required;

(*b*) Hold and save the United States free from damages that may result from the construction and maintenance of the project.

D. A. MORRIS,
*Colonel, Corps of Engineers, Acting District Engineer.*

[First endorsement]

OFFICE, DIVISION ENGINEER,
GREAT LAKES DIVISION,
CORPS OF ENGINEERS,
*Chicago 15, Ill., April 2, 1951.*

To: CHIEF OF ENGINEERS, United States Army, Washington 25, D. C.

I concur in the favorable recommendation of the district engineer.

JOHN R. HARDIN,
*Colonel, Corps of Engineers,*
*Division Engineer.*

LIST OF ILLUSTRATIONS MADE IN CONNECTION WITH THE REPORT OF THE DISTRICT ENGINEER

(Only plate 1 printed)

1. Duluth-Superior Harbor, Minn. and Wis. (file No. D. S. 5086/6 in 1 sheet).

2. Commerce flow chart, Duluth-Superior Harbor, Minn. and Wis. (file No. D. S. 5014/34 in 4 sheets).

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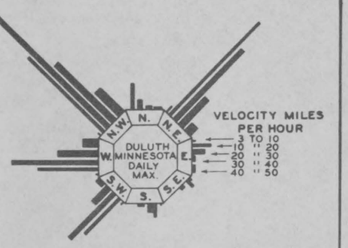
CORPS OF ENGINEERS

U.S. ARMY



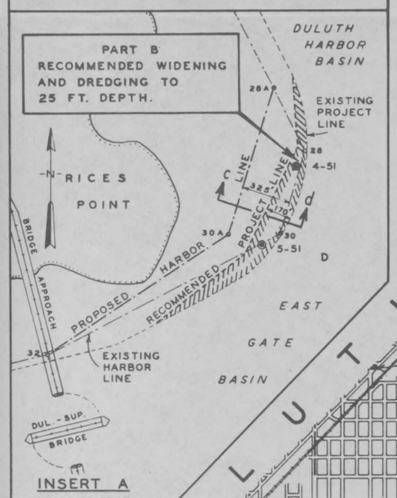

LENGTHS OF RADIATING LINES INDICATE AVERAGE DURATION IN DAYS PER YEAR THUS:-

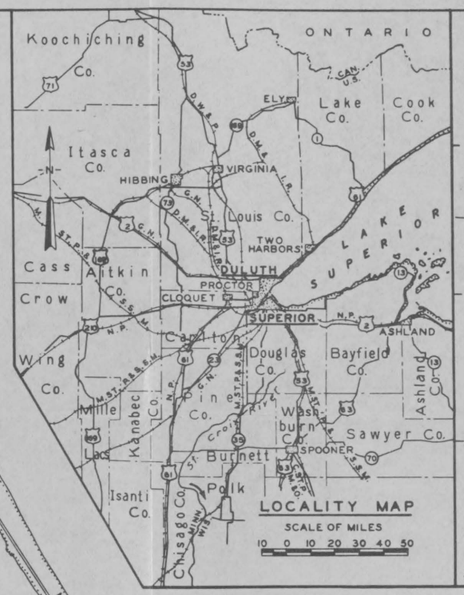
SCALE OF DAYS
10 0 10 20 30 40 50

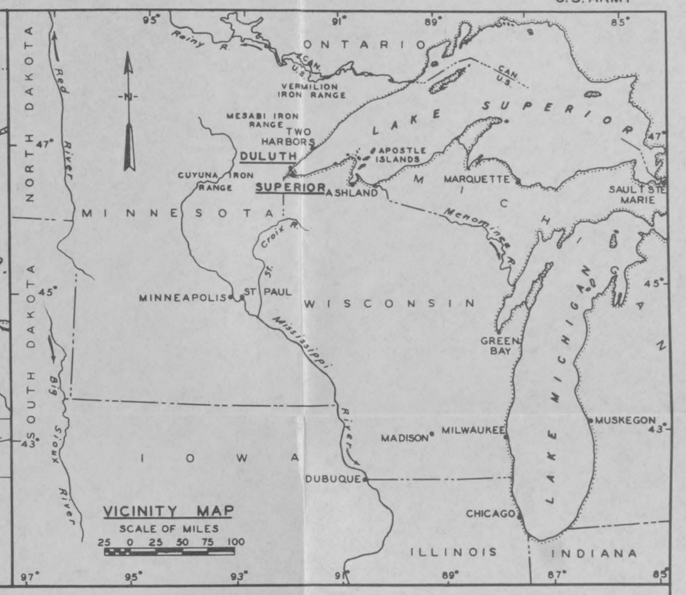
PERIOD 1911 TO 1939 INCLUSIVE

WIND CHART

| DOCK NO. | DOCK |
|---|---|
| 28 | DULUTH, MISSABE & IRON RANGE RY. (ORE) |
| 31 | INLAND COAL AND DOCK CO. |
| 32 | CARNEGIE DOCK AND FUEL CO. (NO. 2) |
| 33 | ZENITH FURNACE CO. (COAL) |
| 48 | FARMERS UNION GRAIN TERMINAL ASSOC. |
| 50 | PHILADELPHIA & READING COAL & IRON CO. |
| 51 | YOUGHIOGHENY & OHIO COAL CO. |
| 52 | HALLET & CAREY CO. |
| 53 | CUTLER-LALIBERTE-MC DOUGALL CORP. |
| 56 | NORTHERN PACIFIC RY. (ORE) |
| 57 | GREAT NORTHERN RY. (ORE) |
| 62 | KNUDSEN BROS. SHIPBUILDING & DRY DOCK CO. |
| 63 | LAKEHEAD PIPE LINE CO. (IMPERIAL OIL CO.) |




PART B
RECOMMENDED WIDENING AND DREDGING TO 25 FT. DEPTH.

PART A
RECOMMENDED DREDGING TO 25 FT. DEPTH.

LEGEND

- DIVISION BETWEEN PROJECT DEPTHS
- EXISTING HARBOR LINE
- EXISTING PROJECT LINE
- PROPOSED HARBOR LINE
- RECOMMENDED PROJECT LINE
- RECOMMENDED DREDGING
- 22 7 SOUNDINGS
- ◉ 6-50 PROBINGS AND TEST PITS
- B PROJECT DEPTH IDENTIFICATION (SEE TABLE BELOW)

NOTES

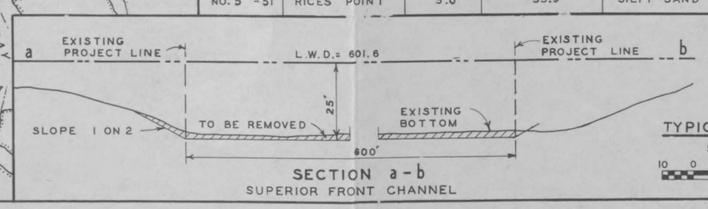
MAP PREPARED FROM DATA ON FILE IN THIS OFFICE, SUPPLEMENTED BY HYDROGRAPHIC AND TOPOGRAPHIC SURVEYS IN OCTOBER 1950 & JANUARY 1951.
SOUNDINGS, PROBINGS AND TEST PITS ARE IN FEET AND ARE REFERRED TO LOW WATER DATUM WHICH IS 601.6 FEET ABOVE MEAN TIDE AT NEW YORK.

SCALE OF FEET
1000 0 2000 4000 6000 8000

SCALE OF MILES
1 3/4 1/2 1/4 0 1/2 1

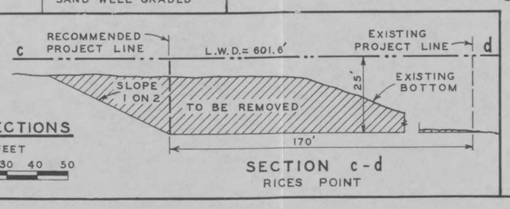
RECORD OF PROBINGS AND TEST PITS

| PROBING & TEST PIT NUMBER | LOCATION | DEPTH OF WATER, FEET | MAXIMUM DEPTH OF PENETRATION, FEET | OVERLYING MATERIAL | MATERIALS AT MAXIMUM DEPTH |
|---|---|---|---|---|---|
| NO.18 -32 | SUPERIOR FRONT CHANNEL | 23.8 | 40.0 | SAND, GRAVEL AND CLAY | CLAY |
| NO.44 -32 | SUPERIOR FRONT CHANNEL | 22.5 | 36.0 | SAND, MUD AND GRAVEL | COURSE GRAVEL |
| NO.49 -32 | SUPERIOR FRONT CHANNEL | 24.2 | 35.0 | SAND, MUD AND GRAVEL | COURSE GRAVEL |
| NO.1 -50 | SUPERIOR FRONT CHANNEL | 22.1 | 27.0 | SILT AND SAND | SAND |
| NO.6 -50 | SUPERIOR FRONT CHANNEL | 22.6 | 27.0 | SILT, SAND AND COURSE SAND | COURSE SAND |
| NO.4 -51 | RICES POINT | 7.4 | 32.7 | SAWDUST & HUMUS | SAND WELL GRADED |
| NO.5 -51 | RICES POINT | 5.0 | 33.9 | SILTY SAND | SAND WELL GRADED |




SECTION a-b
SUPERIOR FRONT CHANNEL

TYPICAL SECTIONS
SCALE OF FEET
10 0 10 20 30 40 50




SECTION c-d
RICES POINT

TABLE OF PROJECT DEPTHS

| Areas | Depths | Areas | Depths |
|---|---|---|---|
| B | 32' | G | 21' |
| C | 26' | H | 20' |
| D | 25' | J | 32' TO 28 |
| E | 24' | K | 32' TO 26' |
| F | 22' | L | 28' TO 25' |

DULUTH-SUPERIOR HARBOR
MINNESOTA AND WISCONSIN

# GENERAL MAP

IN 1 SHEET
SCALES AS SHOWN
DULUTH, MINN. DISTRICT
15 MARCH 1951

SUBMITTED: G.B. Wieder, CHIEF, PLANNING AND REPORTS BRANCH
APPROVAL RECOMMENDED: B. Richmond, HEAD ENGINEER
APPROVED: A.M. Morris, COL., CORPS OF ENGINEERS, ACTING DISTRICT ENGINEER

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TRACED: W.L.
CHECKED: G.B.W.

TO ACCOMPANY INTERIM REVIEW REPORT ON SURVEYS DATED 28 MARCH 1951

FILE NO. D.S. 5086/6

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